

Spatial Modeling in Transportation: Railroad Pricing, Alternative Markets and Capacity Constraints

by

Simon P. Anderson
University of Virginia
and

Wesley W. Wilson
University of Oregon and Institute for Water
Resources

Backdrop

- Evaluating benefits from lock improvements
- Generate demand for transportation services from spatial distribution of activity
- Evaluate impact of market power in various sectors, and welfare gains sources
- Sequence of several papers
- Here, rail vs. barge-truck, market power in rail sector

Broader Issues

- Modeling market power in transportation
- Can apply techniques from product differentiation models to pricing transport services (need to derive demand for transport services)
- insights into spatial pricing patterns
- Importance of potential comp
- hidden welfare gains

Illustrate here with application to barge/rail

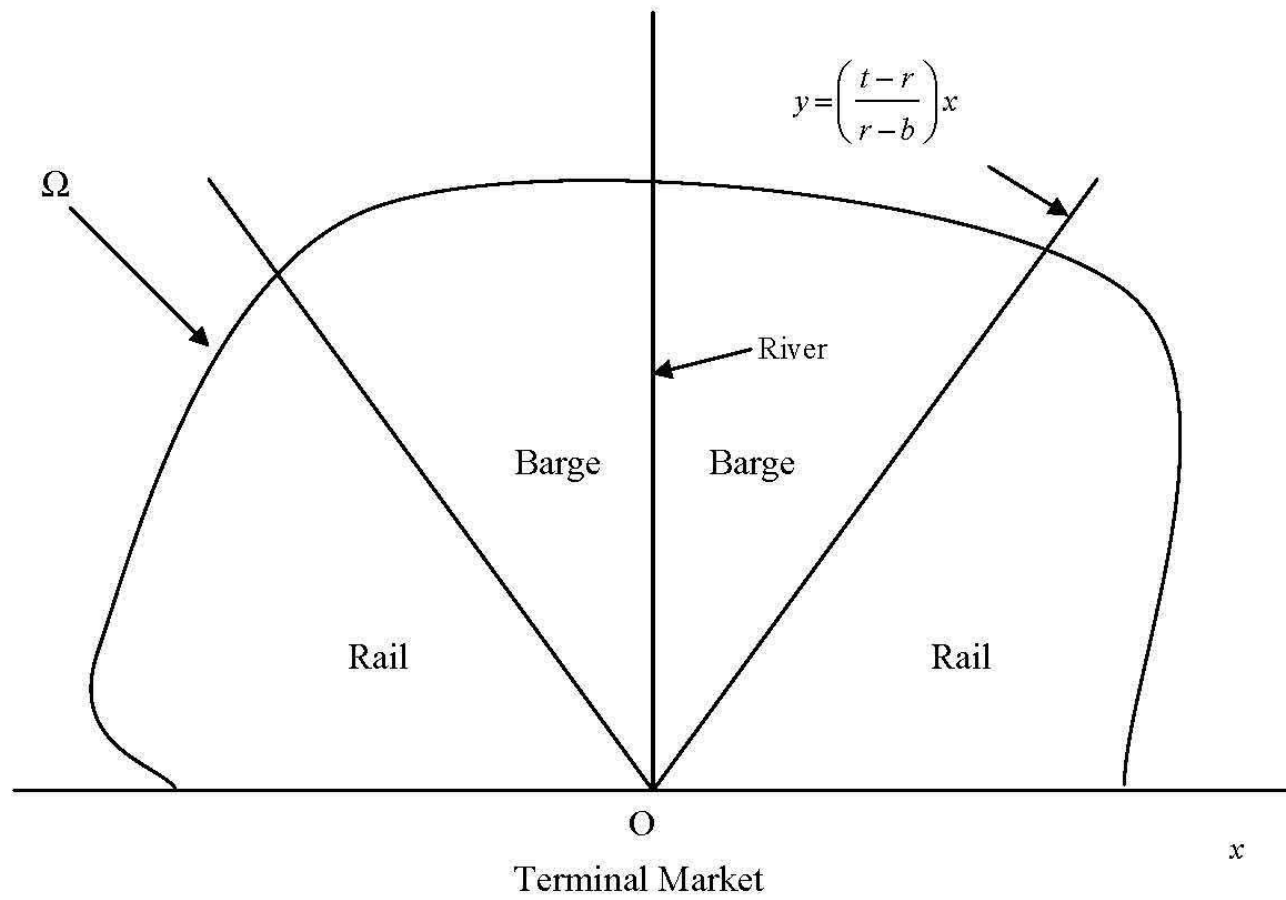
Model

- Economic Geography:
- Farmers spread out over space
- River runs NS, terminal market at 0
- Shipping cost rates (per mile):
 $b < r < t$

Many roads/railways, grid network

- Perfectly competitive shipping
benchmark:

Figure 1

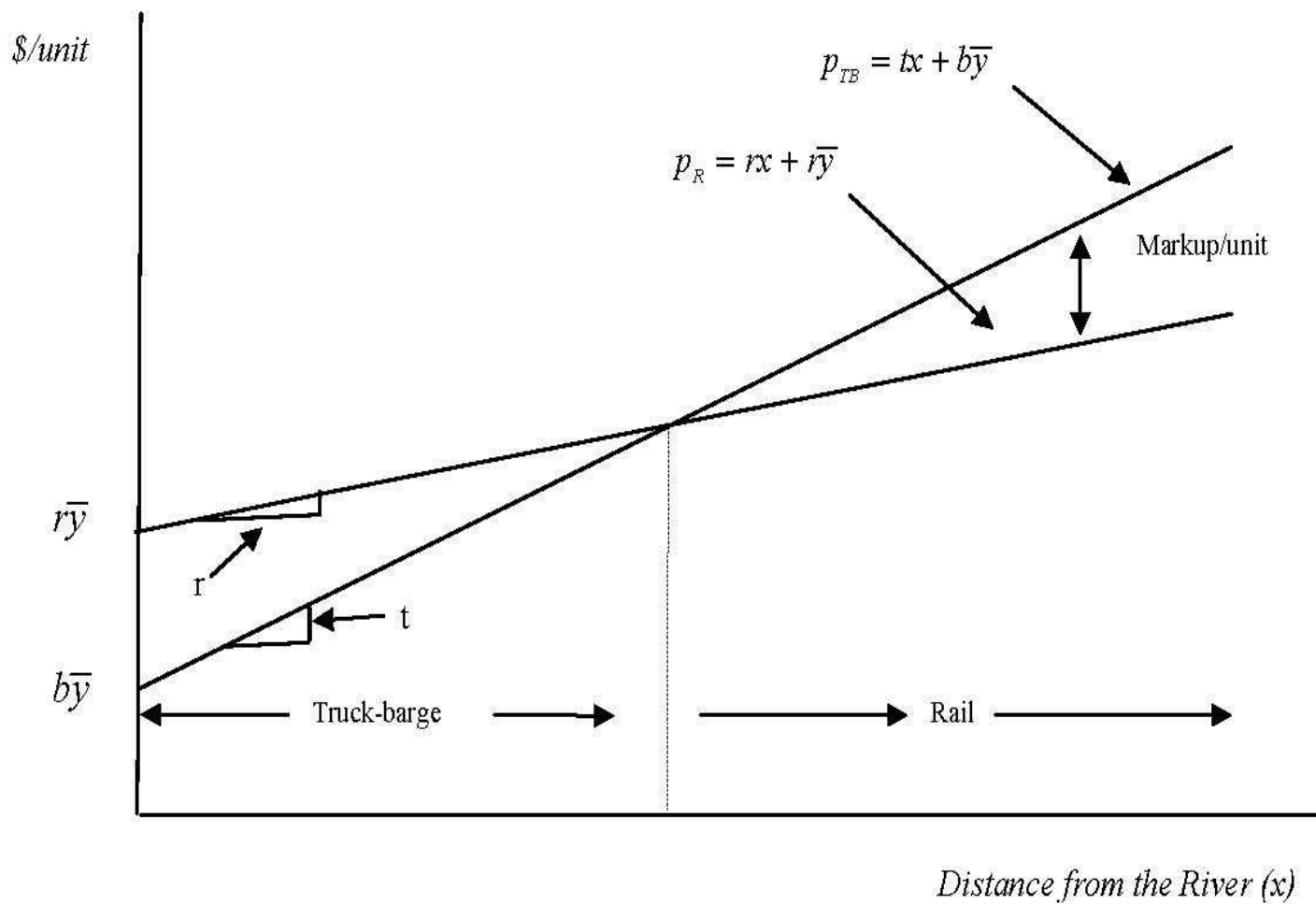


Market Power in Rail Sector

- Pricing to “beat the competition”
(Bertrand)

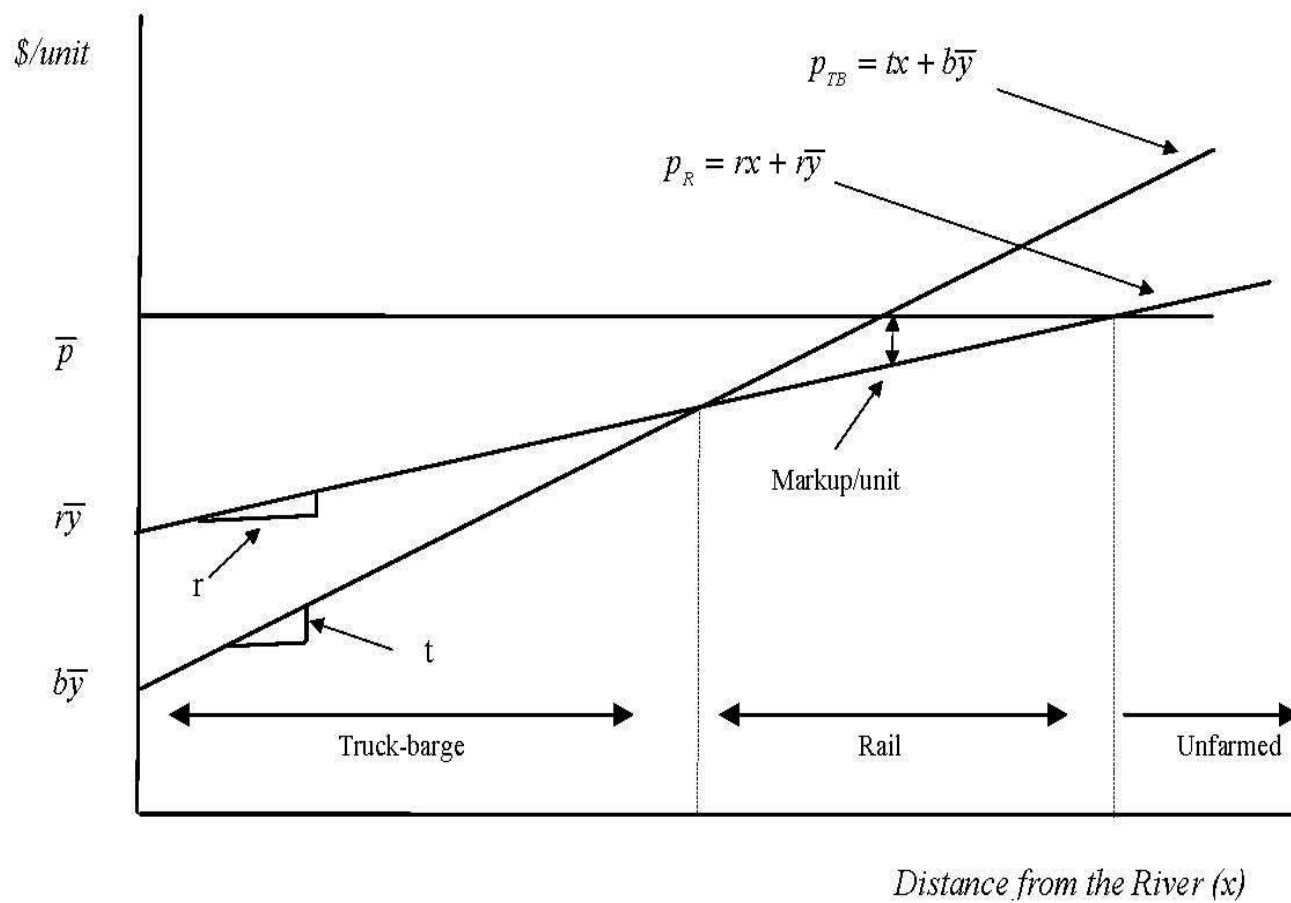
[perfect substitutes version: can readily append Discrete Choice model with idiosyncratic shipper preferences]

Figure 2.



- Now suppose a simple reservation price for farmers (for starters)
- Welfare gains from reducing b

Figure 3.

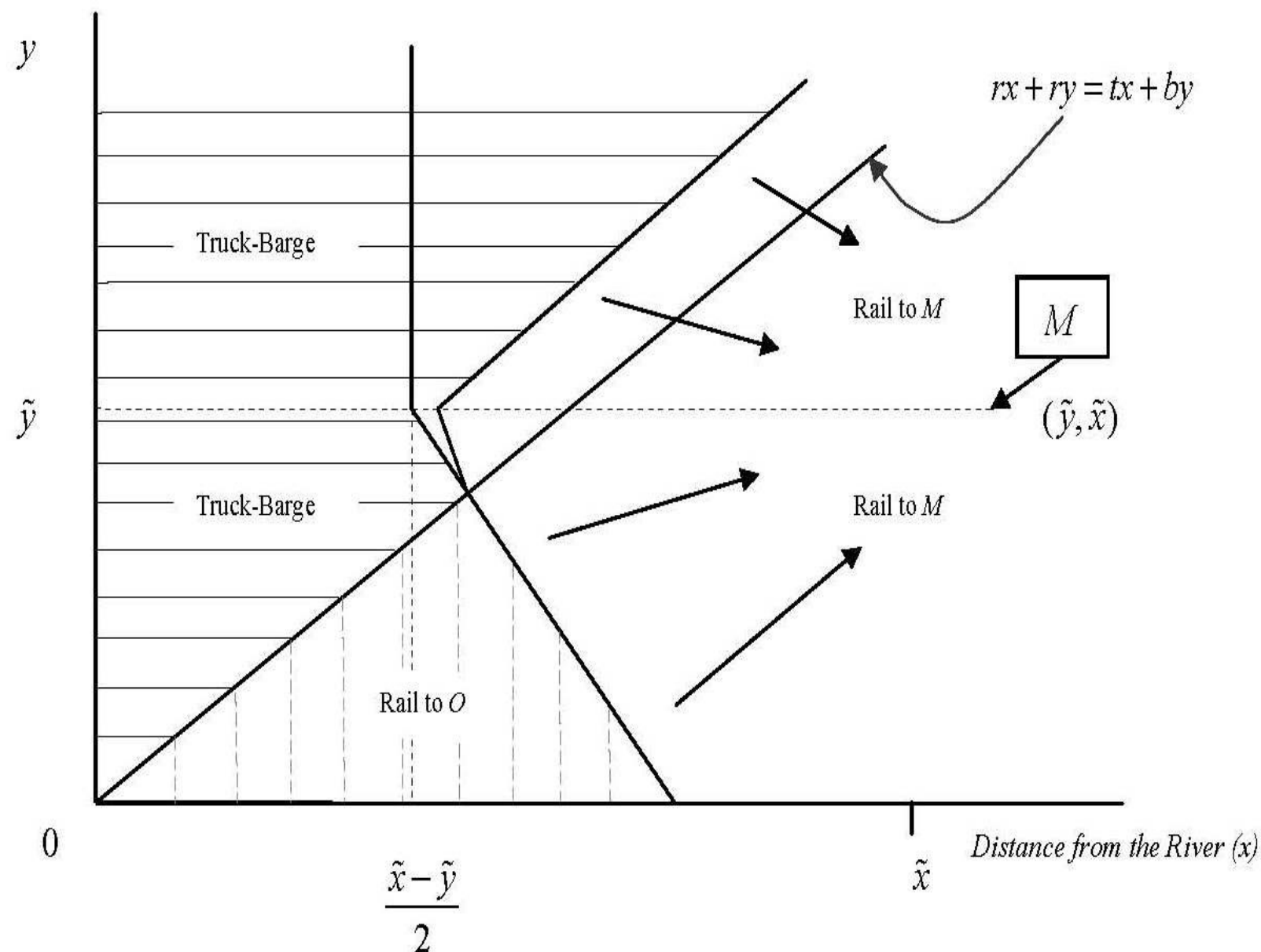


Alternative destination (port)

Again:

- efficient market areas
- transfer from railroad to farmers as b falls

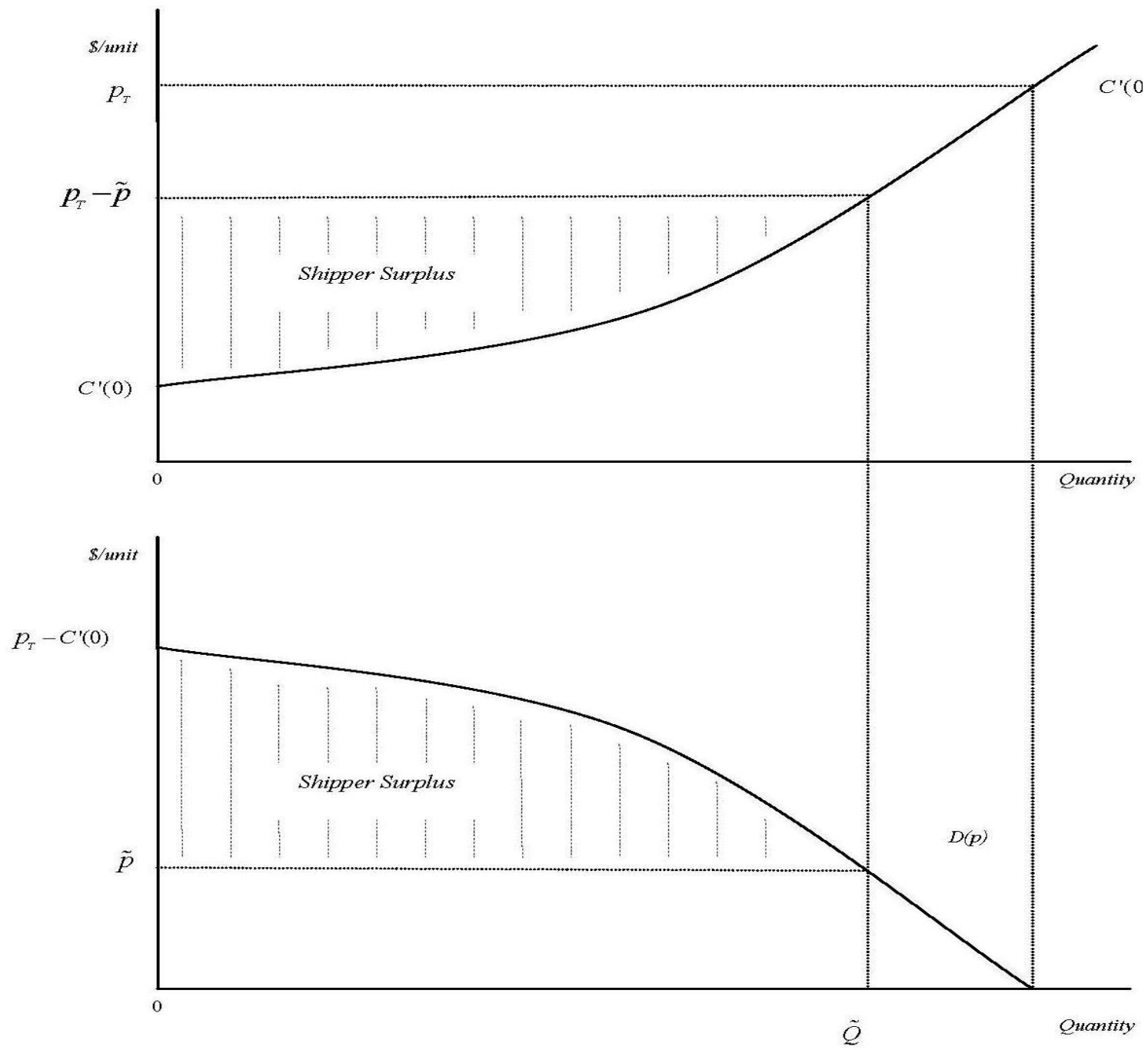
Figure 4. Alternative Port



Farmer demand elasticity

- Demand for shipping services is derived from the farmer's marginal costs and final market price

Figure 5.



Costs and transport demand

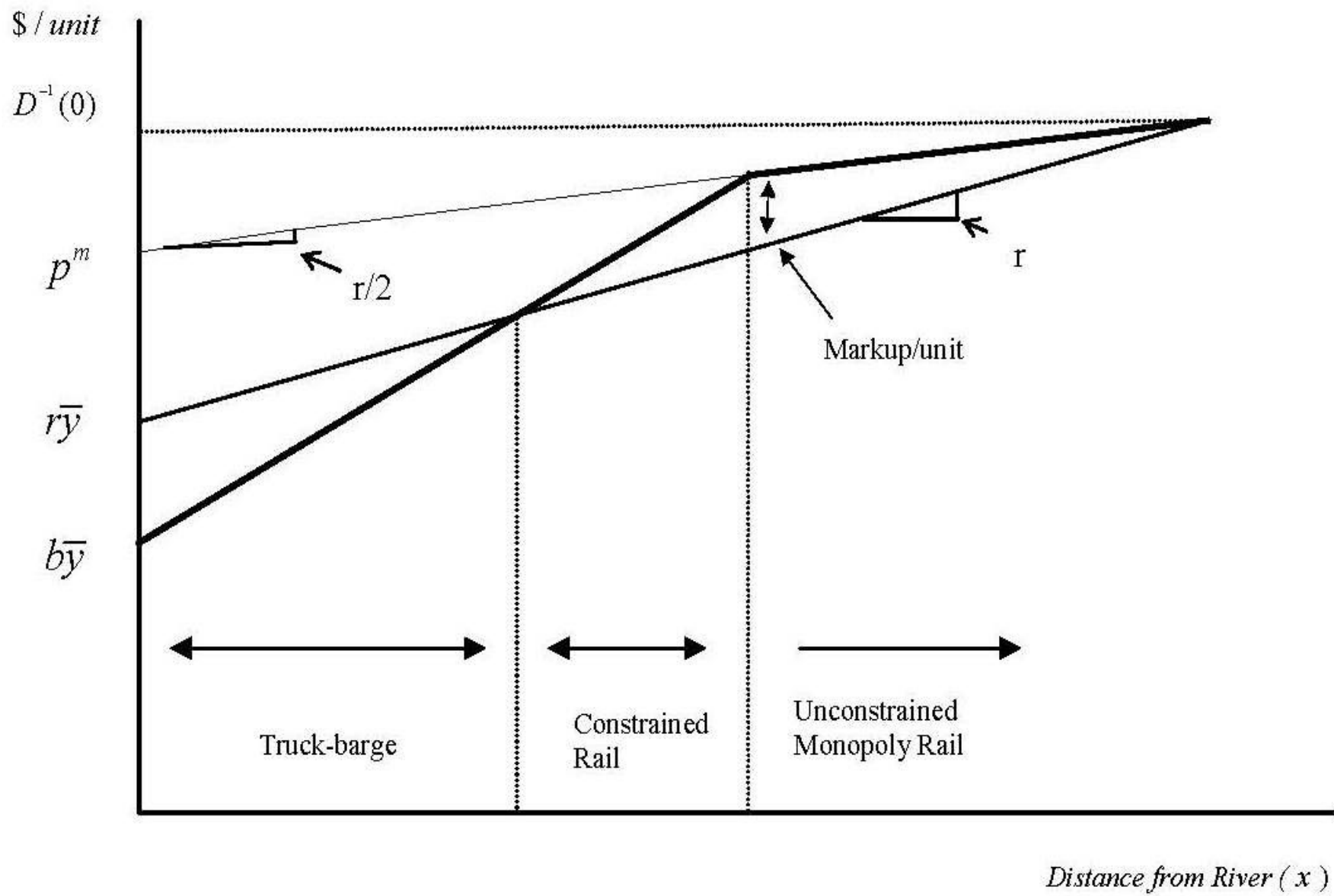
- Linear marginal cost generates linear demand for transport services
- Convex MC gives concave demand ...

Applying monopoly mark-up then gives “freight absorption”: rate charged rises slower than actual cost rises.

True for log-concave demand (not “too convex”)

Log-convex demand has rate rising faster than actual cost rises (“phantom freight”)

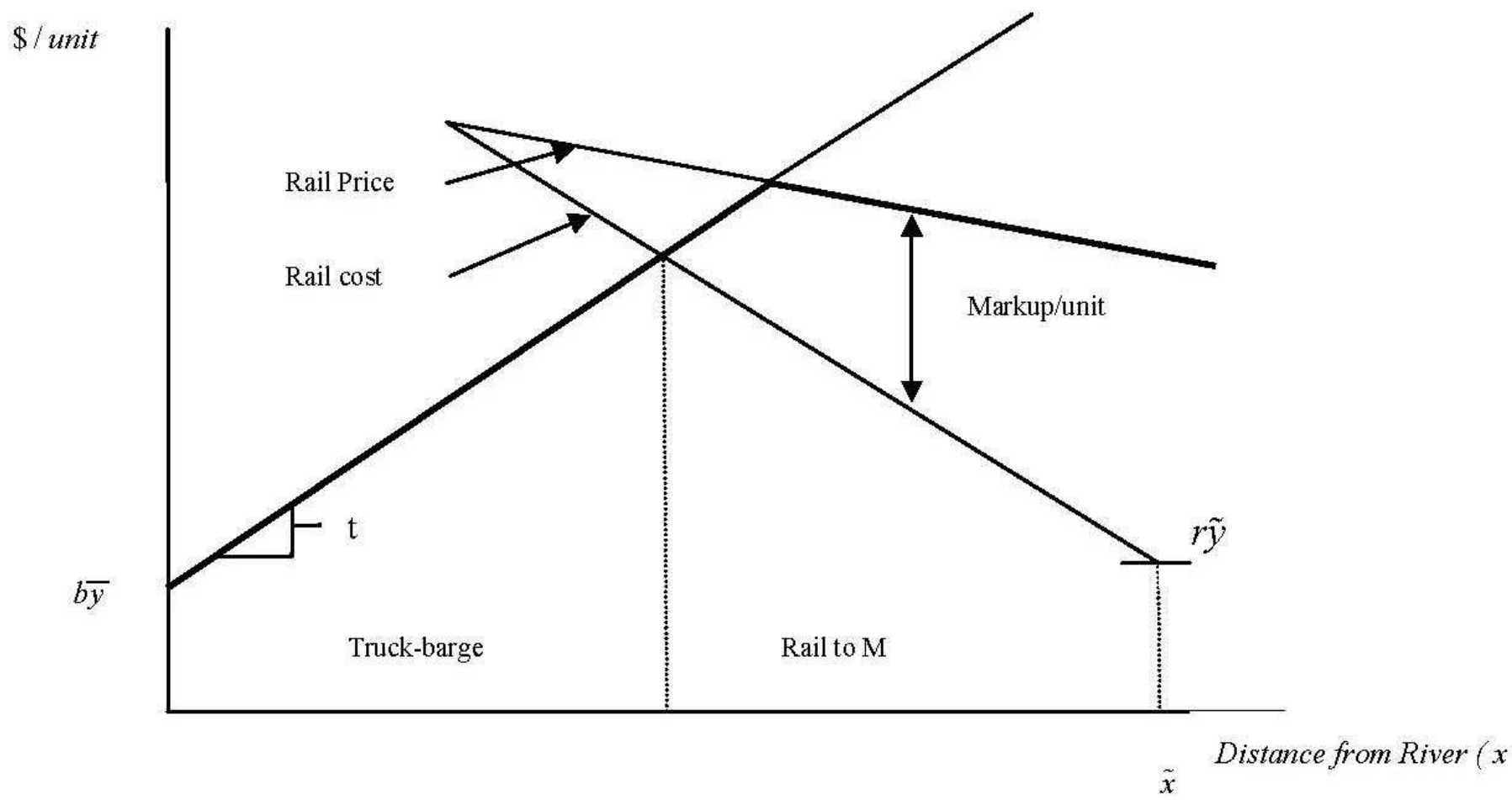
Figure 7.



Decreasing b (lock improvement)

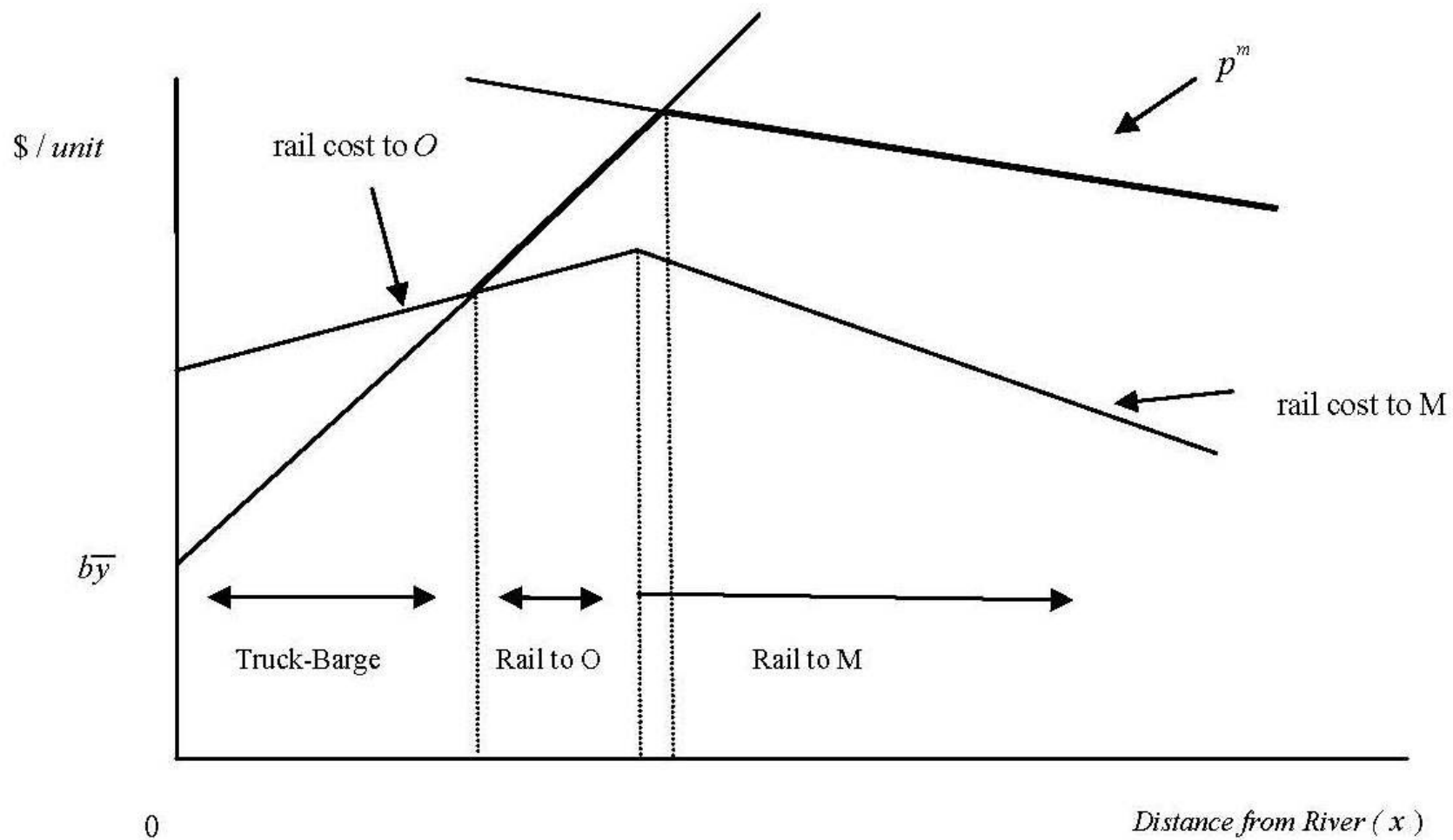
- has beneficial effects in railroad sector
- Reduced deadweight loss where RR just beats the barge rate (but RR profit falls)
- Reduces pure monopoly region
- Similarly for the case of an alternative market:

Figure 8



- Shows benefits even when RR ships to a different final market
- Spatial pricing can be quite intricate, may rise or fall with distance:

Figure 9



Rail Capacity Limits

- Serve the most profitable locations: those furthest from the river

Conclusions

- Differentiated product oligopoly pricing theory carries over nicely enough to pricing of transport services;
- Derive transport demand from production costs
- Pricing patterns – not monotonic in distance
- Hidden welfare benefits as reduce distortion in monopolized sector

Other work, briefly

- Congestion on the river. GE system.
- Market power in barge sector.
Cournot and Bertrand. Chain-linked markets.